Chapter 2 Freeway Management System Elements

The FMS comprises a number of elements, all interconnected and operating together as a system, in order to accomplish the TTG's goals and objectives.

Key FMS field elements discussed within this guideline include:

- Closed-circuit television (CCTV) cameras;
- Communications System, interconnecting devices to the Traffic Operations Center (TOC) and other agencies;
- Detection system sites;
- Dynamic Message Signs (DMS); and
- Ramp meters (See Ramp Meter Design, Operations and Maintenance Guidelines for additional detail).
- Other elements (not discussed in this guideline) include:
- FMS Construction VISION Field Office;
- FMS Maintenance;
- Hardware and software used at the TOC;
- TOC operating staff;
- Traffic Interchange Signals;
- TOC; and
- TTG operational policies and procedures.

2.1 Evolution of FMS Design

The deployment of FMS elements has evolved since the first FMS project. As the FMS has grown and evolved over time, owner experience and technological improvements have driven the need for change. Newer technology must work with existing older *legacy* technology. The need for consistency throughout the system is sometimes challenged by the need to improve it. These guidelines attempt to offer the designer a framework that offers consistency and flexibility for improvement. The designer should be familiar with the overall functionality of the FMS, its field elements and their technologies, and the connectivity between the field elements and their users. Continuous input from maintenance, end users, and construction have helped determine criteria for design.

2.2 Mainline System

The FMS contains a mainline detection system covering each traffic lane. Mainline detection occurs at a spacing of approximately one mile. Generally, preformed loop detectors are used for all new pavement projects. Early FMS deployments utilized mainline detection stations at 1/3-mile spacing; ADOT is currently removing many of these stations in order to achieve the one-mile spacing standard. Data from these detectors is used to electronically determine travel times and abnormalities in traffic flow, which indicate a potential incident. Once an incident is indicated, the FMS operators at the TOC are able to focus the color CCTV cameras with pan, tilt, and zoom capabilities at the potential incident location to confirm the incident.

A Model 179 or Model 2070 controller-based ramp metering system on the entrance ramps limits the demand on a given section of freeway. Information to be communicated to the motorists is displayed using shuttered fiber-optic or light emitting diode (LED) DMS.

All of the field equipment is interconnected to the TOC or to a node building which is connected to the TOC. The field devices are connected using a fiber-optic communications system. Additional TOCs, such as those for other geographic areas and/or back-up TOCs, may be added to the network.

As new freeways are designed and constructed, it is desirable to incorporate certain FMS features to facilitate future FMS operation. To accomplish this objective, the roadway designer is responsible for the geometric design of on-ramps to accommodate dual lane ramp metering. In addition, the designer is responsible for the layout of detection on the mainline freeway and the ramps, the trunkline communications conduit system, pull boxes, to be aware of future equipment foundation locations, and provide conduit or the actual foundation, as appropriate.

Unlike new freeway construction, it is common for FMS elements to be *retrofitted* into existing freeway segments, where the existing FMS infrastructure ranges from non-existent to substantial. Retrofit projects require careful evaluation of existing infrastructure, particularly the available fiber-optic cable strands in the adjacent completed segment of FMS construction.

The design of detection systems, conduits to connect mainline detection systems, ramp meters, CCTV, and DMS is to be initiated in accordance with the guidelines described in this document. Detailed design of the build-out of the FMS system is addressed in the documents listed in Section 1.1.4. The designer is encouraged to be aware of emerging technologies and their effect on FMS design. ADOT is migrating toward National Transportation Communication for ITS Protocol (NTCIP) compliant devices.

Figure 2.1 illustrates typical FMS devices, controller cabinets, and conduit infrastructure for a freeway segment with crossroad interchange.

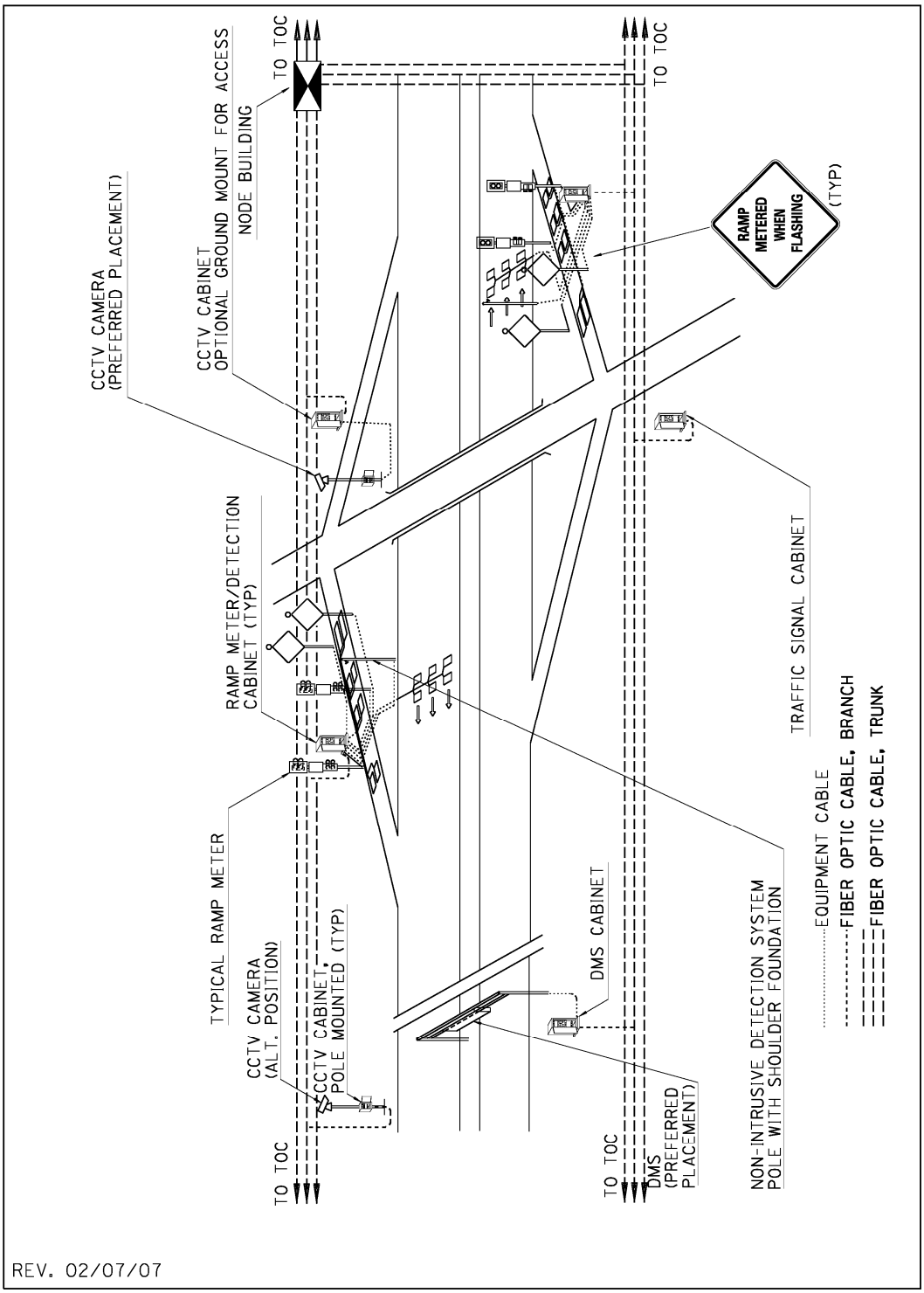

Figure 2.1 Typical Crossroad Interchange

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